WSRC-TR-2003-00083
Revision 2
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WSRC-IM-99-00034

Keywords
Tank Farms
Safety Analysis
Retention
Lifetime

# Concentration, Storage, and Transfer Facilities Justification for Continued Operations

**October 2004**

**High Level Waste Information**
**No ADC/RO Review Required**

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**PREPARED FOR THE U.S. DEPARTMENT OF ENERGY UNDER CONTRACT NO. DE-AC09-96SR18500**

## 1.0 Purpose

This Justification for Continued Operations (JCO) addresses the presence of solids in Tank 50 and solids removal activities. Tank 50 is a Type IIIA waste tank that contains residual tetraphenylborate (TPB) solids. Disposition of the solids involves receipt of supernate solution from the Tank Farm or the addition of water, material agitation via slurry pumps, and transfer of the material to Saltstone. Due to the mechanical agitation of the TPB solids or TPB decomposition, benzene may be released. The CSTF Documented Safety Analysis (DSA) assumes a 5% maximum contribution to vapor space Lower Flammability Limit (LFL) from organics (Ref. 1). Since the benzene in Tank 50 has the potential to contribute more than 5% to the LFL, this JCO is required.

## 2.0 Statement of Problem

The potential exists for release of benzene in Tank 50 as a result of mechanical agitation of the TPB solids or TPB decomposition. Benzene is a degradation product of TPB and is partially retained in the solids. Upon agitation of the solids, a portion of this benzene will be released. In addition, the TPB will continue to degrade, releasing additional benzene.

The CSTF DSA accident analyses assume a maximum organic contribution to the vapor space hydrogen LFL of 5% at 100°C (Ref. 1). Due to the TPB in Tank 50, the organic contribution to the LFL could be significantly higher than 5%. Therefore, this JCO is required to address the risk of Tank 50 operation outside the analyzed conditions in the DSA as well as to recommend compensatory measures to ensure safe operation during solids removal.

Criticality concerns involving the Tank 50 solids have been resolved through an NCSE (Ref. 4). This NCSE concluded that the Tank 50 solids are inherently subcritical, regardless of the enrichment of any feed to Tank 50.

## 3.0 Status of the Facilities

Currently, the TPB solids in Tank 50 are located in "mounds" on the tank bottom or suspended in solution after agitation. The mounds originally occupied an estimated 61,400 gallons (Ref. 2), but subsequent removal activities have reduced this amount significantly. Slurry pumps are installed in Tank 50 and used to agitate and suspend the solids, with the Tank 50 waste being subsequently transferred to the Saltstone Facility.

## 4.0 Risk of Continued Operation

The following discussion addresses the DSA Accidents that are affected by the Tank 50 solids presence and solids removal activities. All accidents were reviewed and those affected were the explosion accidents and criticality. All analyses and controls in the CSTF DSA and TSRs, except those specifically exempted herein, are applicable to the Tank 50 solids and solids removal activities.

Waste Tank Explosion/Waste Tank Annulus Explosion

The unmitigated dose consequences of a non-Type IV waste tank explosion (as reported in the DSA) are above onsite Evaluation Guidelines (EGs) (Ref. 1, Section 3.4.2.11). The Waste Tank Annulus Explosion consequences do not challenge EGs because the annulus does not become flammable within the assumed accident duration timeframe. The accident involving a transfer line break within the annulus could become flammable sooner, but the consequences are greatly reduced due to the limit on inhalation dose potential. The increased organics in the Tank 50 vapor space may result in the tank/annulus reaching flammability faster and may result in greater consequences due to an explosion.

As explained in Reference 3 (which addresses a stoichiometric detonation of benzene), limiting the inhalation dose potential of Tank 50 waste to less than or equal to $2.8 \times 10^5$ Rem/gal reduces the consequences of a waste tank explosion (which bounds the annulus explosion) to approximately 25 Rem onsite and 60 mrem offsite. This inhalation dose potential conservatively accounts for the increase in explosion energetics due to the benzene, resulting in unmitigated consequences well below EGs for the tank and annulus explosions. The bulk supernate in Tank 50 (the material at risk for an explosion) will be required to meet this limit on inhalation dose potential.

To reduce the risk of inadvertent transfers into Tank 50 from the Tank Farm, double valve isolation (or equivalent) will be required between the Tank Farm and Tank 50 except during intended transfers. To ensure the organic material in Tank 50 does not affect any other waste tank, Tank 50 waste shall only be transferred to Saltstone. Transfers from the Effluent Treatment Facility (ETF) to Tank 50 are allowed by this JCO.

Although the hydrogen generation rate for Tank 50 is very low compared to bounding DSA rates, Tank 50 will be designated a "Rapid Generation Tank" to account for the increased organics (Ref. 1, Section 3.4.2.11.1). This designation as a "Rapid Generation Tank," provides for more stringent requirements regarding ventilation flow and vapor space LFL monitoring. Even though the amount of benzene released during slurrying activities may result in exceeding the criteria for entering "Gas Release Mode," Tank 50 will not be required to enter Gas Release Mode due to the limited consequences of the accidents associated with the Tank 50 material. The portable vapor space LFL monitor for Tank 50 will be calibrated with hydrogen, but will have the monitoring result adjusted

to account for the possible presence of benzene (i.e., the reading from the portable LFL monitor will be multiplied by the same factor as the gain that is applied to the Tank 48 CLFL analyzer to account for benzene). Accounting for the presence of benzene in Tank 50 is necessary since the allowed values of LCO 3.8.2 were established based on the assumption that organics contribute no more than the equivalent of 5% of hydrogen's LFL.

Similar to the discussion above for LCO 3.8.2, LCOs 3.8.1 and 3.8.4 have Required Actions written in terms of hydrogen concentration. These actions shall be met by treating the term "hydrogen" as if it were "flammable vapor concentration" (for Tank 50 only). If a portable LFL monitor is used to perform the Required Actions, its indication shall be converted before comparison to the requirements of the LCO using the appropriate conversion factor for benzene.

Transfer Facility Explosion/Transfer Line Explosion

The maximum dose consequences for a Low-Rem transfer do not exceed EGs for the Transfer Facility Explosion (Ref. 1, Section 3.4.2.7). For the Transfer Line Explosion (Ref. 1, Section 3.4.2.6), the consequences exceed the onsite EGs. The higher concentration of organics may increase the consequences of the explosion. However, the limit on inhalation dose potential imposed on Tank 50 will significantly reduce the dose consequences to well below the DSA bounding consequences because bounding inhalation dose potential values are several orders of magnitude higher.

Transfers from Tank 50 to other waste storage locations in the Tank Farm are not allowed. Isolating the transfer path at WTS-V-274 in the Tank 50 Valve Box ensures that no pump tank or other waste tank receives Tank 50 waste. Ensuring isolation at this point also limits the locations that could accumulate waste leakage during the transfer to: 1) the Tank 50 Valve Box, 2) the LDB Drain Cell, 3) the Low Point Drain Tank, 4) Clean-Out Ports along the Tank 50-to-Saltstone transfer line, and 5) jackets associated with the transfer line.

Criticality

As discussed previously, criticality concerns involving the Tank 50 solids have been resolved through an NCSE (Ref. 4). This NCSE concluded that the Tank 50 solids are inherently subcritical, regardless of the enrichment of any feed to Tank 50.

Inadvertent transfer of fissile material into the ETF system presents a criticality concern. This has been evaluated and determined to be incredible due to multiple barriers that are in place to prevent such a transfer as described in DSA Chapter 6 (Ref. 1).

Seismic

During a seismic event, the agitation of solids in Tank 50 could release benzene and cause the tank to reach flammability in less than 7 days. However, due to the limit on inhalation dose potential and the subsequent low consequences, the risk associated with this accident is judged to be acceptable.

## 5.0 Compensatory Measures

To provide protection against an accumulation of flammable concentrations of benzene during solids removal, the following compensatory measures shall be implemented for Tank 50:

1. Designate Tank 50 as a "Rapid Generation Tank" (Ref. 1, Section 3.4.2.11.1). Tank 50 is not required to enter "Gas Release Mode" because, although the amount of benzene released during slurrying operations may exceed the "Gas Release Mode" criteria, the Tank 50 accident consequences are limited by the reduced inhalation dose potential.

2. Limit the inhalation dose potential of Tank 50 bulk supernate to less than or equal to $2.8 \times 10^5$ Rem/gal (Ref. 3). This limit is a mitigative measure to ensure that the consequences of explosion events are bounded by the current DSA accident analyses and to ensure no additional safety basis controls are necessary. Compliance with this inhalation dose potential limit may be ensured by reliance on tank history from the Waste Characterization System. Confirmation of compliance shall be performed via periodic (e.g., concurrent with Tank 50 batch qualification) sampling of representative Tank 50 material. If sampling results indicate the $2.8 \times 10^5$ Rem/gal limit is exceeded, actions shall be initiated IMMEDIATELY to adjust the Tank 50 bulk supernate as necessary to restore compliance with the limit.

3. Implement programmatic controls that require double valve isolation or equivalent (i.e., blank or jumper removal) between the Tank Farm (i.e., transfer pumps, transfer jets, waste locations with siphon potential) and Tank 50 except during intended transfers from the Tank Farm to Tank 50.

4. During transfers out of Tank 50, either close and leak-check valve WTS-V-274 or blank the transfer line immediately upstream or downstream of the valve.

5. Adjust Tank 50 LFL readings to account for the possible presence of benzene.

## 6.0 Conclusions

Although the potential for a deflagration in a waste tank is small, additional measures need to be taken to account for potential benzene releases during solids removal in Tank 50.

While Revision 1 of this JCO increases the inhalation dose potential limit in Tank 50 beyond the Revision 0 limit, the compensatory measures discussed above reduce the potential for and the risks associated with release of benzene due to the presence of solids in Tank 50 to an acceptable level that is bounded by the DSA Accident Analysis. Therefore, it is concluded that the presence of solids in Tank 50 is within the bounds of the compensatory measures outlined in this document.

## 7.0 Exiting the JCO

This JCO will expire after four million gallons of Tank 50 material has been processed through Saltstone to ensure that the TPB solids in Tank 50 are dispositioned in a timely manner. This JCO can be exited prior to expiration if the Tank 50 contents can be shown to meet the DSA requirement that the organics contribute no more than 5% to the hydrogen LFL (at 100°C) (Ref. 1).

## 8.0 References

1. Concentration, Storage, and Transfer Facilities Documented Safety Analysis, WSRC-SA-2002-00007, Rev. 0.
2. Banaszewski, C. D., "Tank 50 Solids Mounds Volume Calculation," J-CLC-H-00793, Rev. 0, November 2002.
3. Webb, M. N., "Evaluation of Tank 50 Airborne Release Accidents," WSMS-LIC-03-00148, Revision 1, May 2003.
4. McCoid, K. J., "Nuclear Criticality Safety Evaluation: Tank 50 Solids," N-NCS-H-00165, Revision 1, May 2003.